

Example 11: Determine the work done to move a 3.5×10^4 kg cargo of space junk from an altitude of 430 km above the Moon's surface to a radial distance of 2.8×10^6 m away.

$$W = \Delta E_p \Rightarrow \text{changing altitudes}$$

$$= -\frac{GMm}{r_2} - \left[-\frac{GMm}{r_1} \right]$$

$$= \frac{GMm}{r_1} - \frac{GMm}{r_2} \quad \leftarrow \text{note the "switch" of } r\text{'s}$$

$$\therefore W = GMm \left[\frac{1}{r_1} - \frac{1}{r_2} \right]$$

$$= (6.67 \times 10^{-11}) (7.35 \times 10^{22}) (3.5 \times 10^4) \left[\frac{1}{(1.74 \times 10^6) + (430000)} - \frac{1}{2.8 \times 10^6} \right]$$

$$\boxed{W = 1.8 \times 10^{10} \text{ J}}$$

→ note that work done to "lift" an object is positive, because E_p is increased.